REMARKS

Reconsideration and allowance of the present application are respectfully requested. Claims 1-20, 22, 23, 25, 27, 28, 30, 32 and 33 remain pending in the application. By the foregoing amendment, claims 1, 2, 4, 8, 10, 12, 14, 15, 18, 20, 22, 23, 27, 28, and 32 are amended.

Applicants note with appreciation the Examiner's indications on pages 5 and 6 of the Office Action that claim 11 is allowed; and claims 4-6, 15, 16, 18, 19, 23, 28, and 33 contain allowable subject matter. In response, claims 4, 15, 18, 23 and 28 are amended to incorporate the base claim, including intervening claims, if any, to place the allowable claims in condition for allowance.

On page 2 of the Office Action, the Examiner rejects claim 22 under 35 U.S.C. §112, first paragraph, alleging failure to comply with the written description requirement. To address the Examiner's concerns, claim 22 is amended. Support for the claim feature can be found in the specification at least at paragraph [0007]. Withdrawal of the rejection under 35 U.S.C. §112, first paragraph, is respectfully requested.

On page 2 of the Office Action, the Examiner rejects claims 14, 20, 22, 27 and 32 under 35 U.S.C. §112, second paragraph, alleging lack of clarity. To address the Examiner's concerns, the relevant claims are amended. Withdrawal of the rejection under 35 U.S.C. §112, second paragraph, is respectfully requested.

On page 3 of the Office Action, the Examiner variously objects to claims 1, 8, 10 and 12; claim 2; and claim 18. To address the Examiner's concerns, the relevant claims are amended. Withdrawal of the objections is respectfully requested.

On page 4 of the Office Action, independent claims 1, 8, 10 and 12, along with various dependent claims, are rejected as being unpatentable over JP A 60-72301 (Morooka) over U.S. Patent 4,575,697 (Rao et al.). On page 5 of the Office Action, dependent claim 7 is rejected as being unpatentable over the Morooka publication in view of the Rao et al. patent, and further in view of U.S. Patent 6,016,122 (Malone et al.). These rejections are respectfully traversed.

An inline phase shifter is disclosed. Included with the device are a waveguide and at least one electromechanical means for changing a physical dimension of a waveguide path. As shown in Figs. 1 and 2, a waveguide 102 has at least one electrically conducting surface and a waveguide path. At least one electromechanical means 106, 108, 110, 112, 114 and 116 can be used to change a physical dimension of a waveguide path to phase shift a signal which travels along the waveguide path, such as a piezoelectric device 310 as shown in Fig. 3, or an electrostatically actuated shutter 524, 526 as shown in Figs. 5 and 6 (e.g., specification at paragraph [0029]). In either case, an electromechanical means has a moveable shutter for changing a physical dimension of the waveguide path (e.g., specification at paragraphs [0019] and [0029]). The electromechanical means can be a micro-electromechanical device which can be contained within the waveguide, as shown Figs. 4 and 5.

As shown in Fig. 2, surfaces of shutters can be electrically connected to a surface of the waveguide 202 with conductive means (paragraph [0020]). The conducting surface configured with electrically connected shutters can alter the dimensions of the conducting surface via actuation of shutters. As exemplified in Fig. 4, the admittance Y along the waveguide path 404 can be modeled to use

impedance matching techniques of transmission line theory. In one instance, the combination of openings is chosen via actuation of shutters so that the desired amount of phase shift and impedance match is achieved (specification at paragraph [00025]). The sets of arrays can also be variously tuned for impedance matching purposes (specification at paragraph [00034]). The impedance matching as Applicants have disclosed can minimize reflection coefficient over a wider frequency bandwidth.

The foregoing features are broadly encompassed by claim 1 which recites an inline phase shifter including, among other features, a waveguide having at least one electrically conducting surface and a waveguide path; and at least one electromechanical means for changing a physical dimension of the waveguide path to phase shift a signal which travels along the waveguide path, wherein the at least one electromechanical means comprises either a piezoelectric element with a moveable shutter or an electrostatically actuated shutter, and wherein the shutter is electrically connected to the electrically conducting surface for phase shift and impedance matching.

The Examiner's rejections relate to changing the physical dimension of a waveguide. Notwithstanding the Examiner's assertions, the Morooka publication does not teach or suggest a shutter being electrically connected to the electrically conducting surface for phase shift and impedance matching, as recited in claim 1. In contrast, the Morooka publication uses inserted dielectric material to introduce phase shift only.

The Rao et al. patent does not cure the deficiencies of the Morooka publication. The Rao et al. patent discloses a bimorph member causing a dielectric

wafer to insert into a waveguide by cantilever action. However, the Rao et al. patent does not teach or suggest a shutter being electrically connected to the electrically conducting surface for phase shift and impedance matching, as recited in claim 1.

The Malone et al. patent do not cure the deficiencies of the Morooka publication and the Rao et al. patent. The Malone et al. reference was applied by the Examiner for its disclosure of a phased array antenna using piezoelectric actuators, but the Malone et al. reference does not teach or suggest a shutter being electrically connected to the electrically conducting surface for phase shift and impedance matching, as recited in claim 1.

Claim 8 similarly recites "inputting a signal along the waveguide path to output a phase shifted signal, wherein the electromechanical device comprises either a piezoelectric element with a moveable shutter or an electrostatically actuated shutter, and wherein the shutter is electrically connected to a conducting surface of the waveguide path for phase shift and impedance matching." Claim 10 recites "a waveguide having conducting surfaces along a waveguide path of the waveguide; and a plurality of electromechanical devices positioned serially along the waveguide path sufficiently adjacent to the waveguide path to change a physical dimension of the waveguide path upon actuation of at least one of the plurality of electromechanical devices, wherein each of the plurality of electromechanical devices comprises either a piezoelectric element or an electrostatically actuated shutter, and wherein the electromechanical devices are electrically connected to the waveguide for phase shift and impedance matching." Claim 12 recites, "at least one micro-electromechanical device positioned sufficiently adjacent to the waveguide path to change a physical dimension of the waveguide path upon actuation of the at

least one micro-electromechanical device, wherein the at least one micro-electromechanical device comprises a piezoelectric element with a moveable shutter or an electrostatically actuated shutter, and wherein the shutter is electrically connected to the waveguide for phase shift and impedance matching."

For the foregoing reasons, Applicant's claims 1, 8, 10 and 12 are allowable. The remaining rejected claims depend from the independent claims and recite additional advantageous features which further distinguish over the documents relied upon by the Examiner. As such, the present application is in condition for allowance.

All objections and rejections raised in the Office Action having been addressed, it is respectfully submitted that the application is in condition for allowance and a Notice of Allowance is respectfully solicited.

Respectfully submitted,

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